[0021] FIG. **10***a* illustrates a side view of another exemplary touch sensitive device with haptic feedback according to embodiments of the invention.

[0022] FIG. **10***b* illustrates a top view of the exemplary touch sensitive device of FIG. **10***a* according to embodiments of the invention.

[0023] FIG. **11** illustrates an exemplary method for providing haptic feedback to an input surface according to embodiments of the invention.

[0024] FIGS. **12***a* and **12***b* illustrate an exemplary electronic device with haptic feedback according to embodiments of the invention.

[0025] FIG. **13** illustrates an exemplary computing system with haptic feedback according to embodiments of the invention.

[0026] FIG. **14***a* illustrates an exemplary mobile telephone with haptic feedback according to embodiments of the invention.

[0027] FIG. **14***b* illustrates an exemplary digital media player with haptic feedback according to embodiments of the invention.

[0028] FIG. **14***c* illustrates an exemplary computer with haptic feedback according to embodiments of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0029] This relates to providing localized haptic feedback at discrete locations or regions relative to a surface of an input and/or output device, such as a touch sensor panel, a display, or a touch screen. Haptic feedback may be provided by controllable nodes configured to selectively transmit a haptic signal (e.g., vibration) to a particular discrete location or region of the surface. The use of haptic feedback can provide an unobtrusive and effective way for a user to know that an input to a device has been received at various locations across the surface and/or for a user to know where an input can be made at various locations across the surface.

[0030] Haptics often refer to those things that relate to the sense of touch. More specifically, haptics may refer to interfaces that provide force and/or tactile sensations. In the context of electronic devices such as consumer electronic devices, haptic interfaces may provide a way for users to receive feedback from the electronic device. The feedback may for example be in the form of a physical sensation that can be felt by the user when the user interacts with some portion of the electronic device.

[0031] In the following description of preferred embodiments, reference is made to the accompanying drawings in which it is shown by way of illustration specific embodiments in which the invention can be practiced. It is to be understood that other embodiments can be used and structural changes can be made without departing from the scope of the embodiments of this invention.

[0032] FIGS. **1***a* and **1***b* are illustrations of an exemplary haptic system in accordance with embodiments of the present invention. The haptic system **10** may be configured to provide a haptic response. The haptic system **10** may for example cooperate with an input and/or output device such as a touch sensor panel, a display, or a touch screen in order to provide a haptic response to the input and/or output device. The haptic response may for example be associated with a particular input and/or output of the input and/or output device.

[0033] As shown, the haptic system **10** may include a plurality of haptic transmission nodes **15** and a haptic signal generator **30**. The haptic transmission nodes **15** may be disposed between a touchable surface **5** and a fixed structure **25** that may be spatially separated from one another. In some embodiments, the nodes **15** may support the surface **5** relative to the fixed structure **25**. The surface **5** may for example be associated with an input and/or output platform and the fixed structure **25** may for example be associated with a printed circuit board, frame, housing or the like. The shape of the surface **5** may be widely varied. For example, it can be flat (as shown) or curved.

[0034] The haptic signal generator **30** may be configured to produce a haptic signal and may be coupled directly or indirectly to the fixed structure **25** such that the haptic signal may travel via the fixed structure **25**. The haptic transmission nodes **15**, which may be coupled to the fixed structure **25** and the surface **5**, may be configured to transmit the haptic signal to the surface **5** so as to provide a physical sensation at the surface **5**. The sensation may for example be associated with a detected touch or near touch relative to the surface **5**. The sensation may even be associated with an input/output event that occurs at the surface **5**.

[0035] As shown, the haptic transmission nodes **15** may be distributed about the perimeter of the surface **5**. In some embodiments, the haptic transmission nodes **15** may be placed at or near the edge of the surface **5**. The nodes **15** may be configured to direct the haptic signal into the surface **5** as for example in a direction away from the edge of the surface **5**. In some embodiments, the haptic signal may even be directed along imaginary or real meridian lines (shown in broken lines) that traverse the surface **5**. The meridian lines may for example be oriented in horizontal and vertical directions. Although shown as straight lines, the meridian lines may take a variety of forms depending on the needs of the system. In some embodiments, the haptic transmission nodes **15** may be positioned directly across from one another on opposite sides of the surface **5**. The nodes **15** may for example cooperate to form a meridian line or be aligned with a meridian line and thus each other. The number and pitch of the haptic transmission nodes **15** about the perimeter may be widely varied (depends on desired resolution of haptic feedback). As should be appreciated, in some cases (as shown), the haptic transmission nodes **15** may be configured to form a matrix of rows and columns across the surface **5**. It should be appreciated, however, that this is not a limitation and that other configurations may be used.

[0036] In some embodiments, the surface **5** may include a waveguide to help encourage the haptic signal to travel to a desired location within the surface **5**. The waveguide may for example help form the meridian lines. The waveguide may take a variety of forms including mechanisms that are embedded, applied or formed into or on the surface **5**. The mechanisms may for example include channels, passages, protrusions, and/or wires that can be placed within or along the backside of the surface **5** and that may extend between opposing haptic transmission nodes **15**.

[0037] In accordance with one embodiment, the haptic transmission nodes **15** may be configured to change states in order to control the transmission of the haptic signal to the surface **5**. The states may be analog, e.g., having a plurality of states from a full transmission state to a full non-transmission state, or binary, e.g., having only a transmission state and a non-transmission state. For ease of discussion, binary is primarily described herein. In some embodiments, for example, the haptic transmission nodes **15** may be configured to selec-